

## Case Study of Seattle Project Impact – Home Retrofit Program

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None of us can stop earthquakes or other natural disaster from occurring. No matter where we live in this world, we are vulnerable to some natural hazards. However we are not without power. We do have the ability to minimize the effects these disasters have on lives and property.

In my area, the way we have found to do this is through a community wide mitigation effort called Seattle Project Impact. Originally borne from a national U.S. initiative from the Federal Emergency Management Agency (FEMA), Project Impact was a focus of seed money, specifically geared toward mitigation, to try to break the disaster-repair-disaster cycle. In Seattle, we truly took the federal concepts a step further by building long-term, sustainable programs that could be first institutionalized and then exported to other cities, counties, or countries which could benefit from an aspect or a complete program.

There are commonalities which exist amongst all of us and some of our ideas may be of interest or use no matter what your regional hazards may be. I am honored to be able to share the information you view here. As I have found, by sharing information in order that others not be forced to re-invent the wheel, we save precious time, lives, and negative economic impacts that can affect us globally.

Partnerships are the key to successful mitigation & preparedness efforts. Every level of the community must be represented; as a chain is only as strong as its weakest link. Seattle Project Impact is a public-private partnership consisting of: local, state, national government; small & large businesses; academicians; scientists; voluntary organizations; neighborhood groups; technical experts; educators; and many others. It is important that partners have an opportunity to participate in the program development, or at a minimum, be kept apprised of progress, so that their expertise and contacts can be brought to bear. Everyone has equal say at the table, all are respected. The best partners are the ones who are motivated to participate and make a difference. Always leave room for new partners who can bring unique or added perspectives to existing efforts.

There are various reasons why people want to become partners and it is important to accept that while they are all bringing something to the mitigation effort, there is also something they are looking for in return. For a private business, it might just be to get their name out to the community as ‘corporate citizen’. For a school district it might be to place a higher priority on previously low-rated nonstructural mitigation. Of course, they must be ethical needs that do not place any other partner in a compromised position. In addressing this “give-and-take” up front, partners are allowed more time toward mitigation program development, implementation and outreach. My experience is that the “give” has far outweighed any of the partner needs for their organizations.

There are three guiding principles that we adopted from our very beginning in 1998 and continue today. They have been integral to the success of our entire program. Firstly, programs need to honor city/business/partner needs & timelines. In our case, we had the U.S. Congress observing our activities with the six other pilot communities, giving us deadlines that had to be met in reporting progress. As these programs were unprecedented, however, sometimes there were timelines that were unrealistic to our development process. Fortunately, as the City of Seattle Department of Emergency Management had the lead on this endeavor, we were able to adjust

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these timelines so that programs did not launch until they were ready. Often times, governmental innovation only has one chance with the public, so it is important to get it right the first time.

Secondly, programs must be of substantial benefit to community. Programs have to be able to make a difference. Our efforts were geared toward the minimization of impacts. So, substance would always win out over the need to show “glitz” and fanfare of a pilot program. As we were being monitored nationally and in constant need of public support, sometimes we could compromise with “glitzy substance”. Either way, the ultimate end would be that we were building a more disaster resistant community.

Thirdly, projects must be designed to be easily exported to other jurisdictions. We benefited from seed money from FEMA, great public-private partnerships, and from momentum. Disasters know no boundaries, so we incorporated the eventuality of expansion into our programs. In program development we chose to include regional expertise to make exporting to other jurisdictions simple. In some cases all other jurisdictions had to do was to take what we had already created, add their city name or logo to the documents, and it would then belong to them. We had already institutionalized corresponding training, so that too made it easier for them to adopt a packaged program and keep their own costs or time commitment low. This was another example of how all communities benefit from sharing information, as it educates and informs to lessen those vulnerabilities. In order to aid in the development of long-lasting mitigation programs, we found these three precepts must assist.

Strong and viable concepts can survive changing administrations, so no matter who is in charge, mitigation efforts can continue to thrive. In the U.S., as portions of our elected officials change every two years, mitigation programs cannot be too identified with an administration, as the next officials may be disinclined to support programs tied to their predecessors. This does not remove, however, the importance of government official’s support. There is a delicate balance.

In many cases, the institutions that govern our communities are far removed from the communities themselves. Those in Washington D.C. sometimes do not have their feet grounded in what is happening or what is best in Washington State, thousands of miles away. The national level is where disaster management is at its most esoteric; the policy or strategy level. It is not where the solutions are. Resources and answers are found most readily at the local level. National level planning can bring to bear national resources, but those at that level of play must be willing to support and not supplant the process as it exists. This makes it imperative that mitigation programs be as insulated from the political processes that affect them as possible. Like disasters, mitigation should know no geographic or economic boundaries, and neither should they know political ones. A community’s answers to mitigation requirements are best found at home. The local experts who call a community home know better what is needed, with whom to work, and how to go about making it happen.

Newly elected/appointed officials should not shy away from existing efforts just because it is not their idea. This concept can be a difficult one, as newly elected officials or the heads of businesses tend to want to distinguish themselves; forge new grounds, and show their abilities as leaders. Where this can be advantageous to those in mitigation efforts is when they work with

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the partnership to see what is needed to expand and improve upon existing efforts. Increasing capacity can only facilitate fortifying the community more readily with solutions.

Mitigation is still good government. Mitigation is the right thing to do, and it should be continued as the hazards are always there, and to walk away is to make our communities more vulnerable. We see that we are responsible to the people we serve. As such Seattle Project Impact's public-private partnership created four mitigation programs: Hazard Mapping, Home Retrofit, School Retrofit, and Disaster Resistant Businesses. I will only be describing the first two programs, although they are all interrelated and have helped us to address mitigation issues across the community.

It may not seem clear as to why the Hazard Mapping Program precedes all discussion of the other programs. But educating the public, our partners, government, etc. about the most recent scientific data on regional hazards has proven extremely important. If people do not understand their vulnerabilities, they will see no value in mitigation. It is important to avoid talk about hazards in ways that scare people, as this rarely motivates them to action. Instead, we explain the hazard, and then describe the resources available to assist them in mitigation. Programs have to be accessible and simple, in order to remove some of their reasons for not taking action previously. Hazard maps assist in this effort by giving direct answers to pertinent questions. People will not take action without understanding. Give them the choice, the informed choice.

We accomplished this by bringing all local hazard experts together under the umbrella of Seattle Project Impact. These included the US Geological Survey, scientists from the University of Washington, private consultants, Geographic Information Systems staff, and other technical experts. They began sharing databases, something that had never occurred before, to assist in researching the findings. Only through these partnerships have we learned about our complete hazards.

Hazard Mapping is the foundation for educating and motivating communities to move toward understanding. It gives them the details they need to make an informed choice of how they want to mitigate their homes and businesses and prepare themselves. Government will always have to focus response efforts on those who have not taken action, but response to a disaster can be lessened by those individuals who have. Other reasons for mapping hazards are that they help planners and builders pinpoint where specific risks exist. By illustrating these risks, the support for mitigation measures can be enhanced at many levels. Also, difficult political choices can be easier to sell to government officials, and in turn to the public, when backed up by good science. With this information, local planners and policy makers will be able to apply the latest, validated scientific information to their deliberations especially in addressing land use issues.

Seattle is a beautiful city of 500,000 with evergreen trees and a hilly topography. Unfortunately, it does rain quite a bit in our region and due to what some of our hills are made of, like sand and glacial deposits, it makes them more prone to landslides. As we also have our earthquake risk, earthquake induced landslides are of grave concern, especially if the quake were to strike during the wet season. Because of past landslide disasters our city, in cooperation with the state and federal government, has spent funds on landslide mitigation efforts. However, we cannot stop the rain, so we must focus additional efforts on educating the public.

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I have a photo of a local landslide which had just occurred, clearly showing the destruction. Six months later, due to our lush growth of vegetation, the slide is much less noticeable. One year later, it is completely obscured by trees and bushes. Our difficulty in this region is that businesses or families will purchase this type of land not knowing its history of instability and proceed to build on or around it. Mapping can assist by detailing where such locations are so we do not have development where it is dangerous. The city has voluminous records of landslides dating back to the late 1800's. But these paper records are only helpful if you know what that you are looking for within the files. More helpful is to take those existing paper records and turn them into three-dimensional maps which clearly depict the risk.

Similar to not seeing past landslide evidence, we do not have the luxury of viewing our earthquake faults. Unlike California where a simple plane ride will take you over the San Andreas Fault, in the Pacific Northwest, we did not know where our faults were. Previously, it was believed that we had no faults which came to the surface. Seven years ago those thoughts were proven wrong. New technology has helped us pin-point our risks yet again. Our most amazing Hazard Mapping has been created by using LiDAR technology. This has allowed us to get below our trees and vegetation and get an actual picture of our ground surface. LiDAR works by employing a fixed-wing aircraft mounted with special equipment which flies back and forth over an area. A laser beam is shot from the bottom of the plane down to the ground, and the beam is bounced back to the plane and recorded, over and over again. This information is recorded and later becomes a preliminary LiDAR map. The next level removes the layer of information that bounced off the vegetation to expose the ground. What we now see are surface faults. Scientist can now dig on the actual faults to learn more about our earthquake hazard and history.

We now have evidence of three different types of earthquakes in the Pacific Northwest area: 1) deep – quakes occurred in 1949, 1969, 2001; 2) shallow – quake 1100 years ago on the Seattle Fault; 3) subduction zone - off the coast of Washington, Oregon, and northern California states which is also capable of a sizable tsunami. Hazard Mapping has become the basis for mitigation against our triple-threat.

Through partnerships, the sharing of information has helped us to better understand our risk through history. Comparing a topographic map of southern Seattle from 1895 with a current geologic map that depicts the areas of damage from the 2001 Nisqually earthquake, we begin to understand. A re-routed river and the deposit of unengineered fill to extend the port made for some susceptible soils. Seattle, a port city like its sister city Kobe, obviously experienced some damage in our 6.8 magnitude earthquake in 2001. However, due to the depth of the quake the damage was focused on areas where our hazards maps had identified susceptibility. When we add to the maps our knowledge of the locations of vulnerable types of construction, we are not surprise to find damage to those buildings. Combined information and expertise can assist in identifying where to build or not build, and types of construction that will perform best in those areas.

All of these maps, the collaboration, and research have laid a great foundation of understanding for our communities and is the basis for action. As new information comes available, we give a

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“heads up” of preliminary information to the affected governments for them decide how they will address requests from the community, then release it directly to the community. We then provide resource information for the public do something with this new information, such as retrofit their homes.

We all learn a lot from other's tragedies and disasters. The sharing of information is the key that can save lives and property in a future disaster. In Seattle, we learned from the California earthquakes that occurred in Loma Prieta in 1989 and Northridge in 1994. We have similar wood-frame construction to theirs and saw story after story of houses that had been retrofitted (sustaining only \$80 US in nonstructural damage on average), surrounded by “red-tagged” homes that had not been retrofitted and were uninhabitable. The small structural retrofit cost saved homeowners thousands of dollars of investment in their houses. Having a home retrofitted gave families somewhere to go, shelter for workers, and piece of mind to families and children. Sadly, displaced families had to deal with the costs of temporary housing, home repairs, and the psychological impacts of being uprooted. These individuals had a difficult time returning to work, if they could at all, impacting businesses and the local economy. These displaced families placed a great burden on local governments to assist with shelter, food, and special needs.

In Seattle our triple-threat of quakes is not represented in our buildings. Modern earthquake code enhancements for homes were not added until the late 1970's – early 1980's, and many of our residential structures were built before that time. 125,000 wood frame homes were built before 1970 in the City of Seattle, with an additional 125,000+ in the surrounding jurisdictions.

There are three vulnerabilities to these unretrofitted wood-frame homes. First, the frame of the home is sitting on top of the concrete foundation held in place only by gravity. There are no bolts securing the house to the foundation, so when an earthquake occurs the house will slide off of the foundation creating major structural damage and pulling out utilities increasing the potential for fire. The house only need slide a few centimeters to cause major damage, making the home uninhabitable.

The second weakness of these houses is that many have a “sheer wall” or “pony wall” that is unreinforced. The “pony wall” is the wood frame between the foundation and first floor. Pony walls add height to one or more walls so that the home can be level and match the land slope. Unfortunately, pony walls are no more than vertical pieces of wood. With the back-and-forth lateral motion of an earthquake, these pieces of wood cannot support the weight of the house above it and the pony wall fails. Again, major damage occurs to the home making it uninhabitable. Lateral reinforcement of the pony wall occurs by adding plywood to increase structural integrity.

The third weakness of these types of homes mirrors the first. Just as the frame is not connected to the foundation, neither are the floor and foundation systems connected together.

The purpose of Home Retrofit is to strengthen the home to move as one connected structure. Bolting the house to the foundation, reinforcing pony walls, and connecting foundation system are all ways to increase structural integrity of these homes and limit injuries to occupants. Retrofitted homes continue to provide shelter in an affected disaster area.

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The Home Retrofit program focuses on addressing this largest exposure to residential structures. The partners began work on modifying basic plans sent to us by a city in California. This was another example of sharing information to save lives. Our partners began modifying the plans to fit our specific construction in the region.

These pre-engineered plansets provide solutions for various typical wood-frame homes, to keep costs down, and to streamline a permit process. The permit process is key as it provides quality control (one inspection when the bolts go in, one after the plywood is in place) so regardless whether the homeowner does the work or they hire a trained contractor to do the work, there is someone checking to make sure it was completed properly. Permits are approved on an expedited basis as the building officials are the ones who helped develop the plansets. Nineteen cities and counties are using these same plansets, a truly regional program.

One of our purposes in creating the pre-engineered plans is to remove a major reason that people don't mitigate against disaster, or in this case specifically, don't retrofit. Costs to the homeowner are kept low by removing the need to hire an engineer for typical retrofitting and simplifying the process. But the homeowners may still have questions, so training and education are the answer. Classes allow homeowners to make informed decisions to fit their needs.

After homeowners discover that their home may need retrofitting, they are provided information about on-going classes. These two-hour classes provide all plansets and materials. They are given instruction on how to do an assessment of their home to identify weaknesses, and then told which solutions to apply to their individual home. Instructors use a "model wall" to demonstrate retrofit options and proper tool usage. Tied to the Home Retrofit program is a Tool Lending Library for homeowners to borrow needed specialized equipment which also assists in keeping their costs low.

At the end of the class, the homeowner has choices as to how to move forward with their retrofit. They can either perform their own retrofit, using the Tool Lending Library, or they can hire one of the trained contractors to complete the work. Either way they choose, they have taken the class and are an informed consumer. Contractors have commented on how valuable it is in lessening confusion by having the homeowner educated as to the process, noise, time, and scope of the retrofit. It is especially valuable for the homeowners to understand the importance of the permit and inspections as that protects the homeowner and may assist them in getting earthquake insurance.

While originally held only in the City of Seattle, nineteen jurisdictions now participate so that classes are hosted around the region to inform a broader base and have been institutionalized. Also useful has been the use of a free phone number allowing homeowners to call from anywhere for class information. Over 3,200 homeowners have completed the two-hour class.

It would be unrealistic to believe that all homeowners would perform their own retrofit. Building professionals need to be trained on new Home Retrofit standards, as some of the updates came directly from the two California earthquakes. We therefore worked with our partners to develop professional training that could be institutionalized in order to continue this

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needed community benefit. Training is hosted by the University of Washington's School of Architecture and Urban Planning. The six-hour Home Retrofit training for building professionals goes into much greater detail on the plansets, rationale for design elements, codes and standards. This training is open to general contractors, architects, inspectors, engineers, and building officials. City and county building departments have chosen to send their permitting staff to this training. After completing the training, professionals have the choice of being added to the contractor referral list distributed to homeowners and on our web site. The referral list of qualified contractors, made available to the public, is updated on a monthly basis. Training reinforces that this retrofit work is permit-driven and, should a contractor do un-permitted work, they will be removed from the referral list. Permits and inspections are to the benefit of both the homeowner and contractor as it provides quality control.

Through this process we learned that there were some contractors in the field whose construction practices were less than admirable. By requiring training to perform retrofit from our list, we are ensuring that those who are working with homeowners have more than basic skill with or above the code.

So, the Home Retrofit standards and guidelines are in place, the classes are on-going for homeowners, and training is available for contractors. The next steps involve the costs for retrofit. Homeowners fall into two groups, those who can and those who cannot afford to retrofit. The cost for a homeowner to retrofit their own average-cost home is ½ % of the value of the home. To have a contractor perform the retrofit, the cost can be 2% of the value of the home. Obviously, it is more costly to hire for professional work, but if that is too costly, homeowners can simply pay for parts and materials then perform their own retrofit.

The majority of unretrofitted homes are owned by people who can afford to pay for retrofitting in some way. They can pay using their own funding source such as credit cards, or take out a loan from one of our partnering financial institutions. These banks and credit union offer special loan packages tied to the Home Retrofit permit. Some families have tied reconstruction, weatherization, or expansion loans to their retrofit in order to perform work in the same area at the same time.

Low-income individuals have advocates, federal programs, and assistance on a daily basis and after disasters. High income and even middle income have their own resources to prepare themselves and property. But low-to-moderate income individuals and families are "on their own". They do not have advocates or programs to assist them. They are barely making ends meet, and when a disaster happens, they are the ones who typically fall off the map and move out of the area. They are unable to maintain their circumstances, repair or recoup losses, and recover. This is why we are providing grants to those individuals, making 80% of median income or below, to structurally retrofit their homes. Grants are not to exceed \$5,000 so if there are additional problems with the home, such as dry rot, they may need to get a low-income loan to cover the additional expense. Our Home Retrofit Grant program has already seismically strengthened 112 homes, with another 73 to be complete in August 2005. This grant program is also made possible through a partnership with contractors and engineers volunteering their expertise to make these families safer.

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All mitigation programs should have ties to emergency management, but to be truly institutionalized, they need to fall into the responsibility of those who typically manage such efforts. For instance the building officials should manage the standards and guidelines updates. Emergency management gets programs started and keeps them running, but eventually will need to transfer some of the program management to the appropriate organization. In our case, we never cut the ties entirely in order to provide on-going support to departments and organizations who are now keeping aspects of mitigation programs running. For example, we institutionalized our training for building professionals at the university, homeowner classes available around the region are scheduled through a non-profit organization, and expedited permits are available in all participating jurisdictions using the same plansets which also standardizes all training and classes.

A way to support on-going mitigation is to continue to educate and inform the public. If we have a great program and resources, but no one knows it exists then it is not serving anyone. So we are constantly working with the news media, have an extensive web site, and put out information through partners to continually keep the information on the forefront.

While we focus Home Retrofit on structural work, we also provide nonstructural retrofit information to all homeowners as there are many who live in newer construction or in multi-family housing. By securing their belongings within the structure, they are decreasing the potential injuries to adults and children in their households. This is just an example of taking the opportunity to educate wherever possible. Many times individuals share this information with friends and families, which has an even greater effect.

To date, we have strengthened over seven-hundred houses through Home Retrofit, and many more are in progress. Our success is measured one house at a time, as that is the only way we know our mitigation message has been received and action taken. Classes have taught over three-thousand two-hundred homeowners and four-hundred forty-eight building professionals, with additional classes occurring right now. Nineteen cities and counties are participating on Regional Home Retrofit, all using the same adopted pre-engineering plansets and expedited permit process. Permit inspections will ensure that retrofits are completed properly no matter whom performs the work.

We created a baseline of money that was leveraged by local partners over four times in our first three years. Most of what the partners have contributed is not hard dollars as much as their experts' invaluable time spent on developing and maintaining programs. The spirit of mitigation was not to create a project with a start/end date, but instead to create programs with institutionalized strategies to reduce hazards in the long-term. Knowing also that we were fortunate to receive this seed money, we developed programs that could be sustainable through changing political heads, and could be exportable to other jurisdictions facing the same risk. Other jurisdictions do not have the benefit of money or partners, so we included regional expertise to make the program expansion easier and less of a burden to the local jurisdictions to implement: a community legacy.